



Preliminary data

SPI21N10  
SPP21N10, SPB21N10

## SIPMOS® Power-Transistor

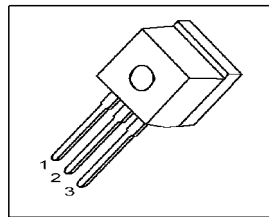
### Feature

- N-Channel
- Enhancement mode
- 175°C operating temperature
- Avalanche rated
- dv/dt rated

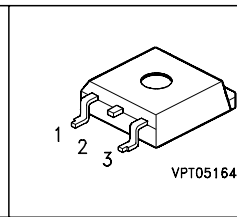
### Product Summary

$V_{DS}$	100	V
$R_{DS(on)}$	80	mΩ
$I_D$	21	A

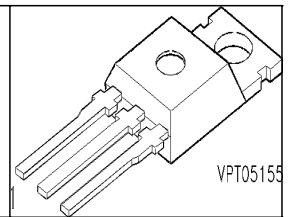
P-TO262-3-1



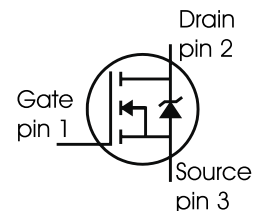
P-TO263-3-2



P-TO220-3-1



Type	Package	Ordering Code	Marking
SPP21N10	P-TO220-3-1	Q67042-S4116	21N10
SPB21N10	P-TO263-3-2	Q67042-S4102	21N10
SPI21N10	P-TO262-3-1	Q67042-S4117	21N10



Maximum Ratings, at  $T_j = 25^\circ\text{C}$ , unless otherwise specified

Parameter	Symbol	Value	Unit
Continuous drain current	$I_D$	21	A
$T_C=25^\circ\text{C}$		15.0	
$T_C=100^\circ\text{C}$			
Pulsed drain current	$I_{D \text{ puls}}$	84	
$T_C=25^\circ\text{C}$			
Avalanche energy, single pulse	$E_{AS}$	130	mJ
$I_D=21 \text{ A}$ , $V_{DD}=25\text{V}$ , $R_{GS}=25\Omega$			
Reverse diode dv/dt	dv/dt	6	kV/μs
$I_S=21\text{A}$ , $V_{DS}=80\text{V}$ , $di/dt=200\text{A}/\mu\text{s}$ , $T_{j\text{max}}=175^\circ\text{C}$			
Gate source voltage	$V_{GS}$	±20	V
Power dissipation	$P_{\text{tot}}$	90	W
$T_C=25^\circ\text{C}$			
Operating and storage temperature	$T_j, T_{\text{stg}}$	-55... +175	°C
IEC climatic category; DIN IEC 68-1		55/175/56	

## Thermal Characteristics

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Characteristics					
Thermal resistance, junction - case	$R_{thJC}$	-	-	1.7	K/W
Thermal resistance, junction - ambient, leaded	$R_{thJA}$	-	-	62	
SMD version, device on PCB:	$R_{thJA}$				
@ min. footprint		-	-	62	
@ 6 cm <sup>2</sup> cooling area <sup>F)</sup>		-	-	40	

## Electrical Characteristics, at $T_j = 25^\circ\text{C}$ , unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static Characteristics					
Drain-source breakdown voltage $V_{GS}=0V, I_D=1mA$	$V_{(BR)DSS}$	100	-	-	V
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D = 44 \mu A$	$V_{GS(th)}$	2.1	3	4	
Zero gate voltage drain current $V_{DS}=100V, V_{GS}=0V, T_j=25^{\circ}C$ $V_{DS}=100V, V_{GS}=0V, T_j=125^{\circ}C$	$I_{DSS}$	- -	0.01 1	1 100	$\mu A$
Gate-source leakage current $V_{GS}=20V, V_{DS}=0V$	$I_{GSS}$	-	1	100	
Drain-source on-state resistance $V_{GS}=10V, I_D=15.0A$	$R_{DS(on)}$	-	65	80	$m\Omega$

<sup>1</sup>Device on 40mm\*40mm\*1.5mm epoxy PCB FR4 with 6cm<sup>2</sup> (one layer, 70  $\mu m$  thick) copper area for drain connection. PCB is vertical without blown air.

Electrical Characteristics, at  $T_j = 25^\circ\text{C}$ , unless otherwise specified

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

### Dynamic Characteristics

Transconductance	$g_{fs}$	$V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$ , $I_D = 15.0\text{A}$	6.5	12.4	-	S
Input capacitance	$C_{iss}$	$V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$	-	650	865	pF
Output capacitance	$C_{oss}$		-	140	186	
Reverse transfer capacitance	$C_{rss}$		-	80	120	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 50\text{V}$ , $V_{GS} = 10\text{V}$ , $I_D = 21\text{A}$ , $R_G = 13\Omega$	-	10	15	ns
Rise time	$t_r$		-	56	84	
Turn-off delay time	$t_{d(off)}$		-	37	55	
Fall time	$t_f$		-	23	35	

### Gate Charge Characteristics

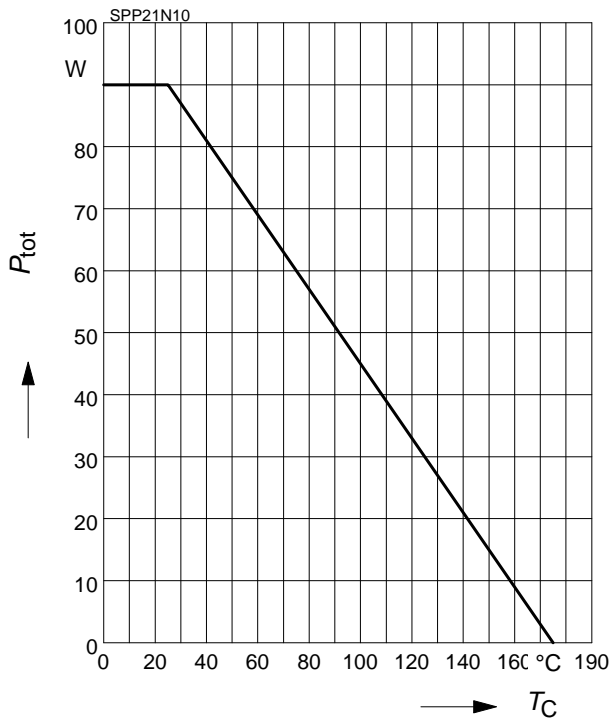
Gate to source charge	$Q_{gs}$	$V_{DD} = 80\text{V}$ , $I_D = 21\text{A}$	-	3.9	5.2	nC
Gate to drain charge	$Q_{gd}$		-	15.5	23.3	
Gate charge total	$Q_g$	$V_{DD} = 80\text{V}$ , $I_D = 21\text{A}$ , $V_{GS} = 0 \text{ to } 10\text{V}$	-	28.9	38.4	
Gate plateau voltage	$V_{(plateau)}$	$V_{DD} = 80\text{V}$ , $I_D = 21\text{A}$	-	6.2	-	V

### Reverse Diode

Inverse diode continuous forward current	$I_S$	$T_C = 25^\circ\text{C}$	-	-	21	A
Inverse diode direct current, pulsed	$I_{SM}$		-	-	84	
Inverse diode forward voltage	$V_{SD}$	$V_{GS} = 0\text{V}$ , $I_F = 21\text{A}$	-	0.94	1.25	V
Reverse recovery time	$t_{rr}$	$V_R = 50\text{V}$ , $I_F = I_S$ , $di/dt = 100\text{A}/\mu\text{s}$	-	65	81.5	ns
Reverse recovery charge	$Q_{rr}$		-	153	192	nC

### 1 Power dissipation

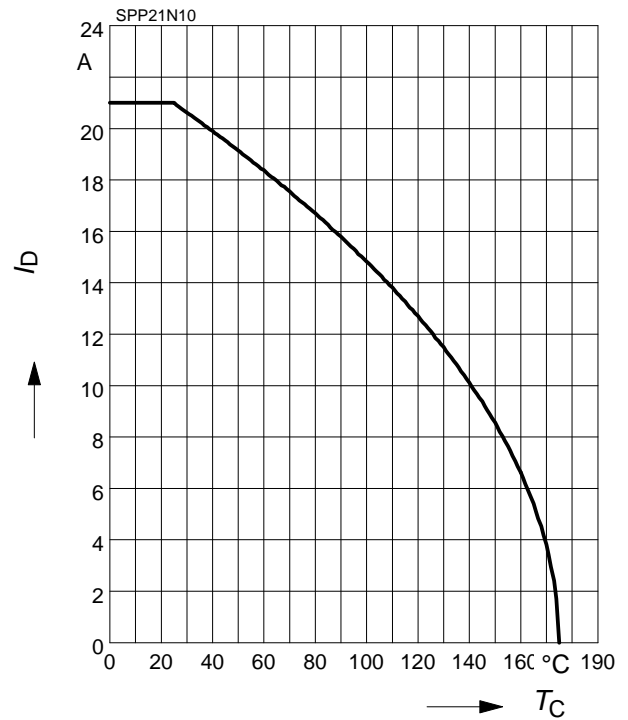
$$P_{\text{tot}} = f(T_C)$$



### 2 Drain current

$$I_D = f(T_C)$$

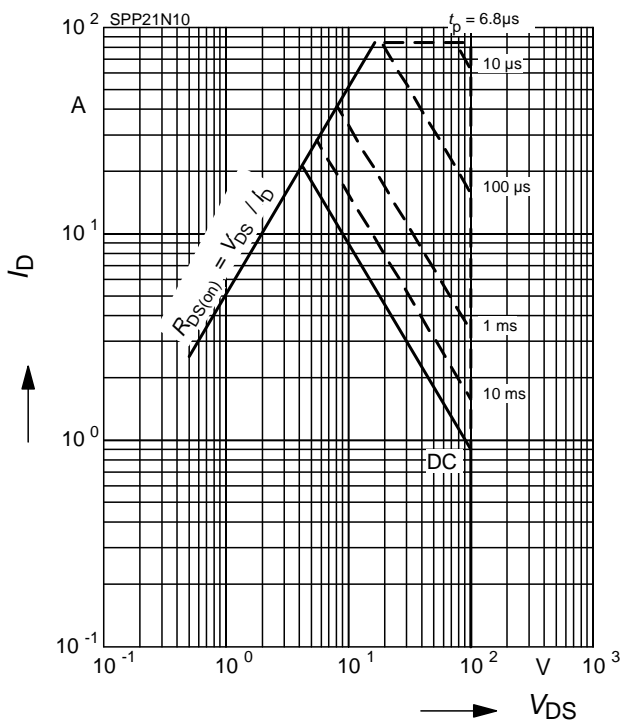
parameter:  $V_{GS} \geq 10$  V



### 3 Safe operating area

$$I_D = f(V_{DS})$$

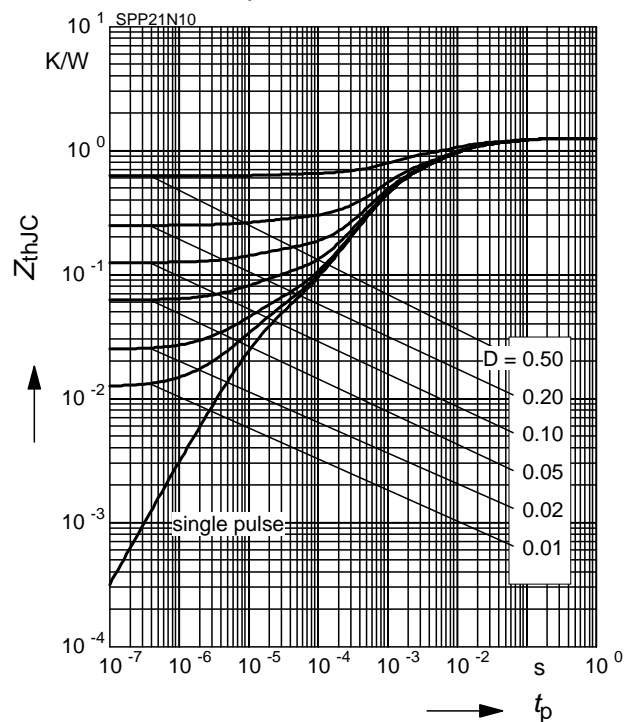
parameter:  $D = 0$ ,  $T_C = 25$  °C



### 4 Transient thermal impedance

$$Z_{thJC} = f(t_p)$$

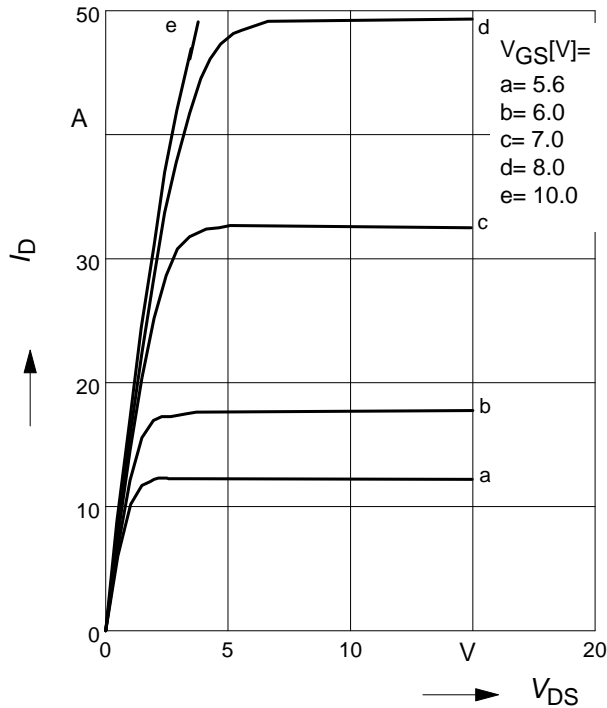
parameter:  $D = t_p / T$



### 5 Typ. output characteristic

$I_D = f(V_{DS}); T_j = 25^\circ\text{C}$

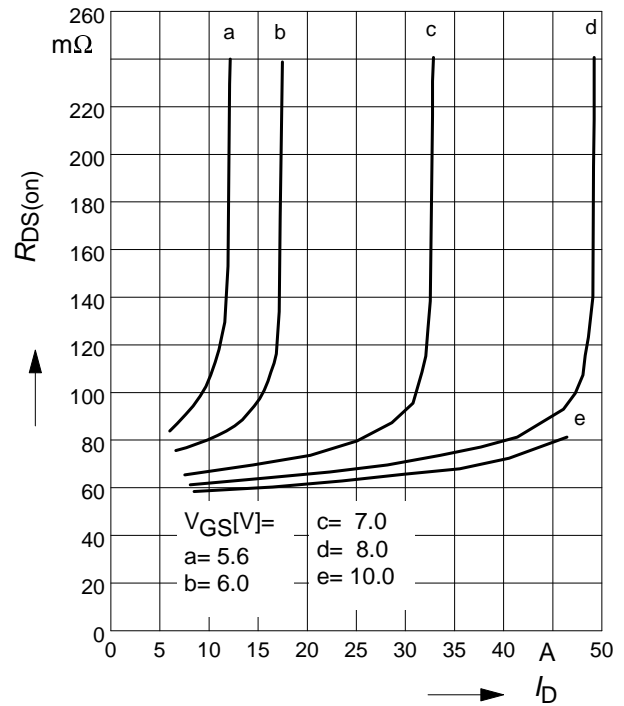
parameter:  $t_p = 80 \mu\text{s}$



### 6 Typ. drain-source on resistance

$R_{DS(on)} = f(I_D)$

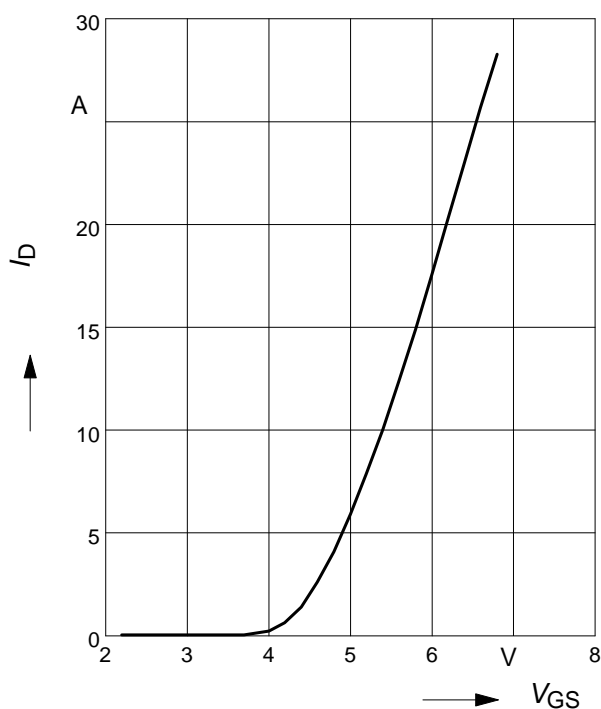
parameter:  $V_{GS}$



### 7 Typ. transfer characteristics

$I_D = f(V_{GS}); V_{DS} \geq 2 \times I_D \times R_{DS(on)max}$

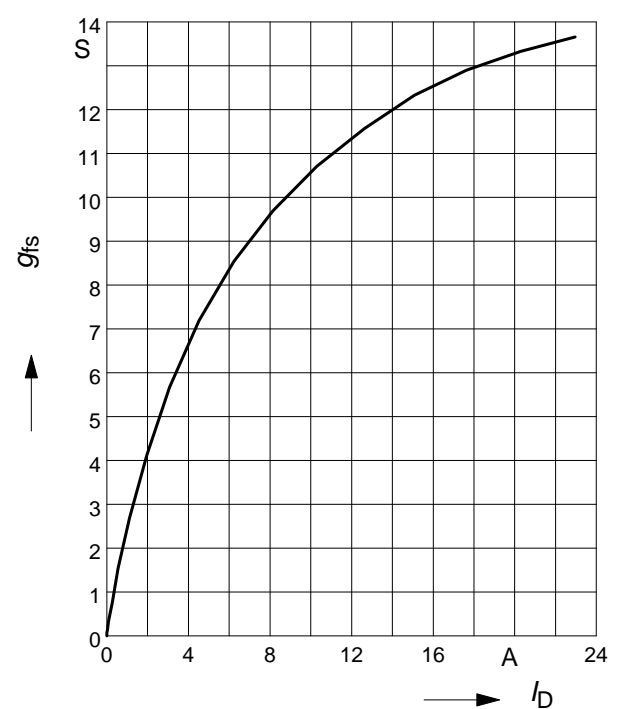
parameter:  $t_p = 80 \mu\text{s}$



### 8 Typ. forward transconductance

$g_{fs} = f(I_D); T_j = 25^\circ\text{C}$

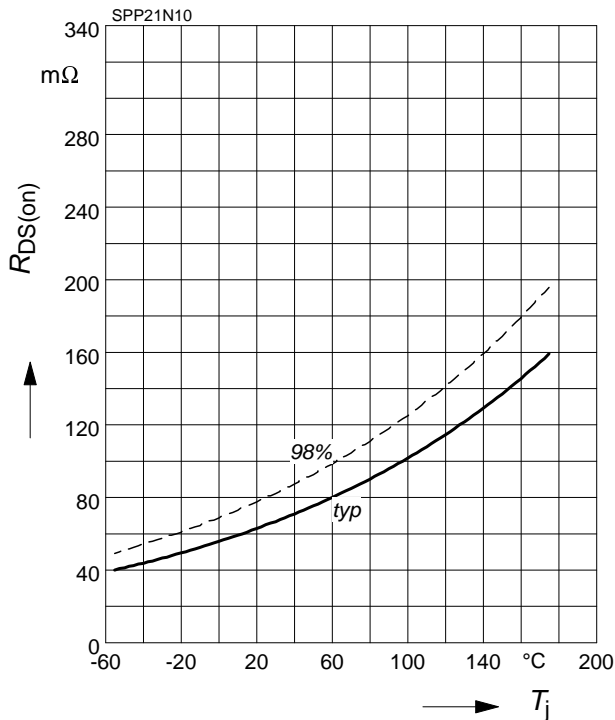
parameter:  $g_{fs}$



## 9 Drain-source on-state resistance

$$R_{DS(on)} = f(T_j)$$

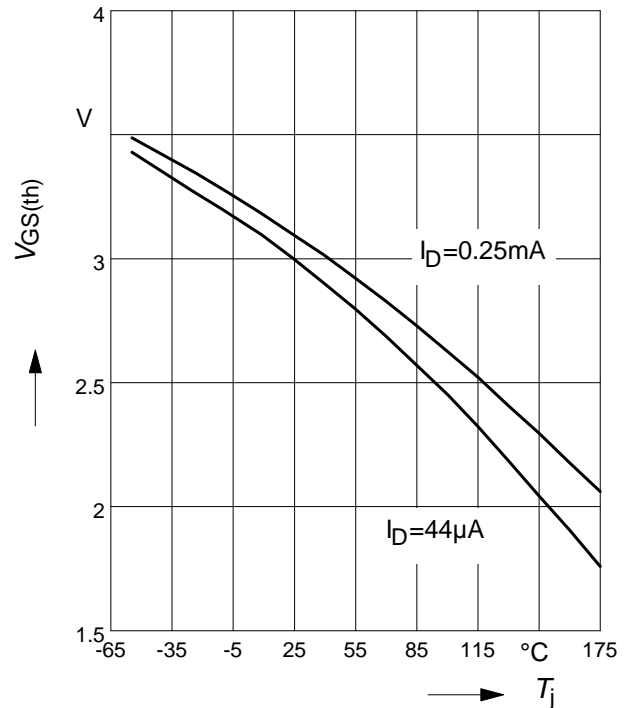
parameter:  $I_D = 15.0 \text{ A}$ ,  $V_{GS} = 10 \text{ V}$



## 10 Typ. gate threshold voltage

$$V_{GS(th)} = f(T_j)$$

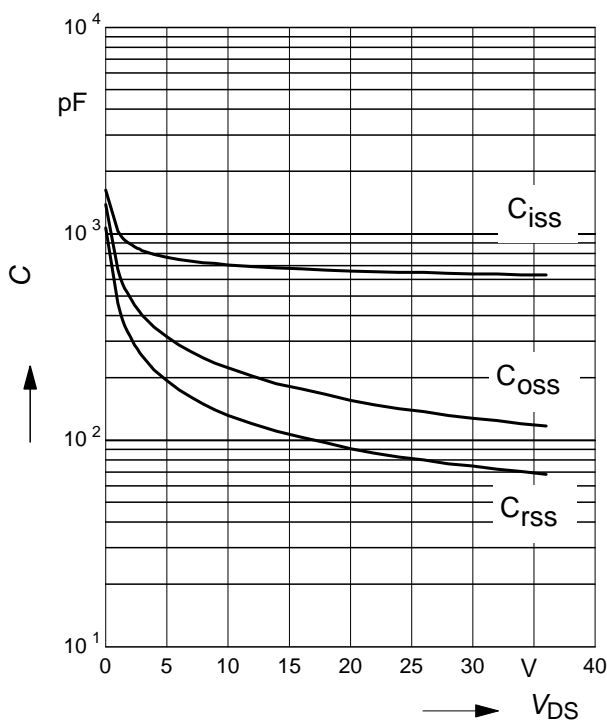
parameter:  $V_{GS} = V_{DS}$



## 11 Typ. capacitances

$$C = f(V_{DS})$$

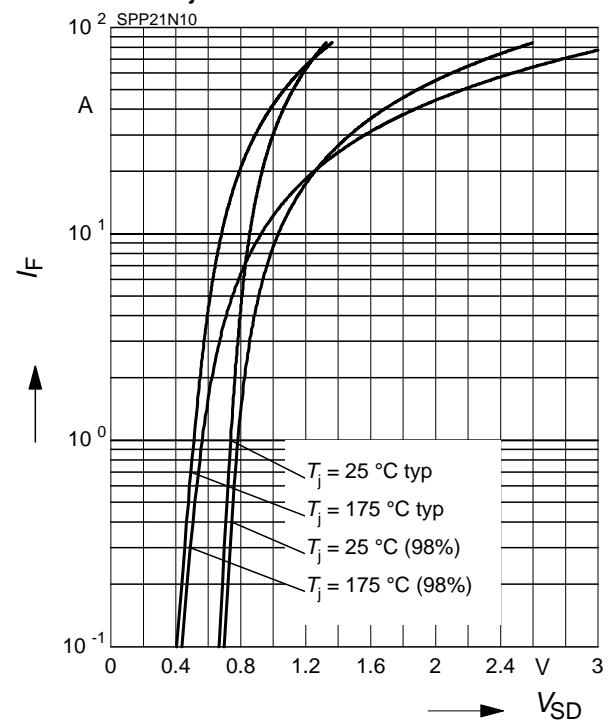
parameter:  $V_{GS} = 0 \text{ V}$ ,  $f = 1 \text{ MHz}$



## 12 Forward character. of reverse diode

$$I_F = f(V_{SD})$$

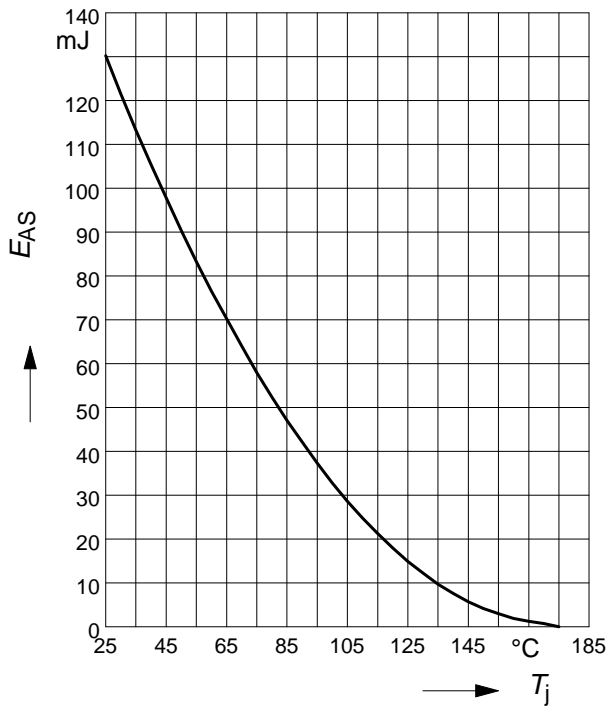
parameter:  $T_j$ ,  $t_p = 80 \mu\text{s}$



### 13 Typ. avalanche energy

$$E_{AS} = f(T_j)$$

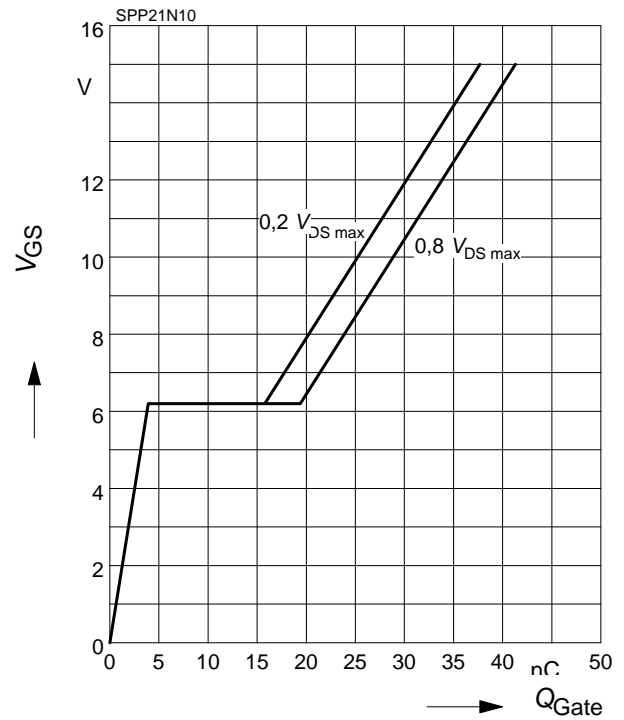
par.:  $I_D = 21\text{ A}$  ,  $V_{DD} = 25\text{ V}$  ,  $R_{GS} = 25\ \Omega$



### 14 Typ. gate charge

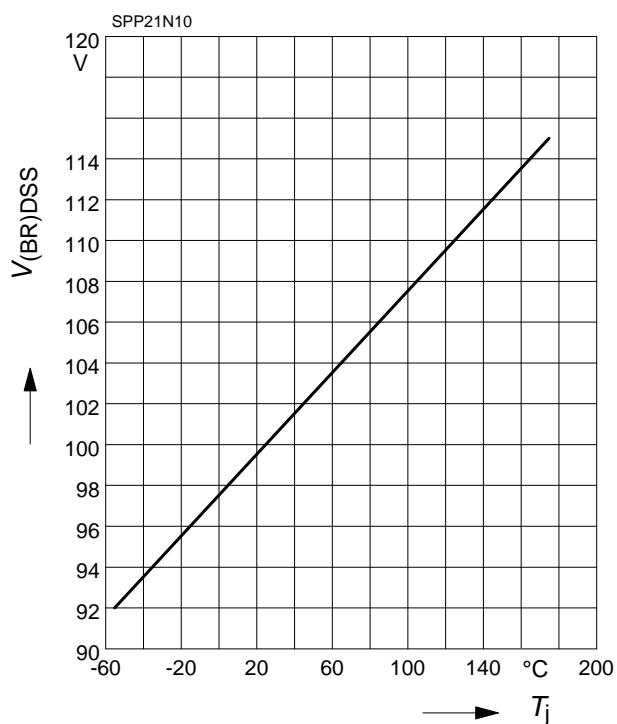
$$V_{GS} = f(Q_{Gate})$$

parameter:  $I_D = 21\text{ A}$  pulsed



### 15 Drain-source breakdown voltage

$$V_{(BR)DSS} = f(T_j)$$



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